

ASIAC

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REVISION A

ANALYSIS TECHNIQUES  
FOR  
A-7D AIRCRAFT  
IN-FLIGHT RECORDER DATA

JUNE 1980

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AEROSPACE STRUCTURES  
INFORMATION AND ANALYSIS CENTER

OPERATED FOR THE AIRFORCE FLIGHT DYNAMICS LABORATORY  
BY ANAMET LABORATORIES, INC.

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This report summarizes the planned method of analysis of the A7D flight loads data collected by multi-channel recorders. The verified results will then be used to produce exceedance curves and histograms. This work was the preliminary step in a complete analysis of data to be conducted at a later date.

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I. INTRODUCTION

This effort was conducted to study the techniques necessary to analyze A-7D flight loads data collected at Davis-Monthan AFB, Arizona, Selfridge Air National Guard (ANG) Base, Michigan, and Toledo ANG Station, Ohio, by Mr. David L. Banaszak, AFWAL/FIBG, using multi-channel flight loads recorders. Three axis accelerations, three axis rotations, altitude, and airspeed were recorded on tape magazines as shown in Table 1. These magazines were then sent to Wright-Patterson AFB where the Structural Vibration Branch (FIBG) of the Flight Dynamics Laboratory condensed the raw data on standard 9-track computer tapes. At this point the Aerospace Structures Information and Analysis Center (ASIAC) was contacted to examine the data and to consider reducing this data into a form suitable for presentation in a technical report.

TABLE 1  
 OUTPUT DATA SYMBOL AND UNITS

SYMBOL	DEFINITION	UNITS
A	Altitude	Feet
V	Velocity	Knots
X	X acceleration $N_x$	g's
Y	Y acceleration $N_y$	g's
Z	Z acceleration $N_z$	g's
P	Roll	Degrees per sec.
Q	Pitch	" " "
R	Yaw	" " "
Time	Time	1/30 second
I	Two or more of the above listed data points falling in the same band	

## II. EXPLANATION AND INTERPRETATION OF THE DATA

Table 2 gives a listing of the 9-track computer tapes and their contents. These contents are data files which were created by compressing the raw data from the in-flight recorder magazines. This raw data was condensed by using a computer program written by FIBG (Structural Vibration Branch) WPAFB, Ohio. Table 2 goes on to note which of the tapes listed are usable and to what extent they are usable.

A particular raw data tape is one magazine from one in-flight recorder. This raw data tape then comprises one file on the condensed data tape. Each file is a monitoring of one aircraft for the length of time that the in-flight recorder was in use on this aircraft, so each file may contain many flights.

The computer program LCOMP, written by FIBG, was used to scan each compressed data tape and print output tables with one of the following options:

- (1) A tabular listing of altitude, airspeed, accelerations in the x, y, and z directions, roll pitch, yaw and time.
- (2) A graphical representation of the above parameters.
- (3) Both a tabular and graphical representation of the above parameters, as shown in Table 3.

The computer program LCOMP scans each data tape and prints the following output in order:

- (1) Identification data - data used to identify the aircraft, base, etc.
- (2) Engineering units - this is a table of values which creates 64 bands for each parameter (altitude, airspeed, acceleration in x, y, and z directions, roll, pitch, yaw, and time.)
- (3) Output selection by option:
  - (a) A tabular listing of each parameter.
  - (b) A graphical representation of each parameter
  - (c) Both tabular listing and a graphical representation of each parameter.

TABLE 2

LISTING OF TAPES

TAPE NO.	CONTENTS	USABILITY (If Bad; Reason Bad)
X01061	11 Files	All Files Usable
X02560	6 Files	All Files Usable
X00185	6 Files	5 Files Good (Bad file due to incomplete file)
X02980	9 Files	All Files Good
X03327	9 Files	All Files But 2 Good (2 files only partial)
X03499	8 Files	All Files Bad (Data very inconsistant)
X04143	8 Files	All Files Bad (Tape unable to be read without parity errors)
X00872	7 Files	All Files Bad (Data inconsistant)



TABLE 3. TYPICAL LCOMP OUTPUT

[illegible]

The identification data presents information concerning aircraft tail number, squadron, base, number of flights, aircraft gross weight at takeoff, and recorder magazine number. This data is used to identify the aircraft from which the data came. Calibration data is also included as shown in Table 4. This is used in the calculations of flight times and for the creation of the 64 bands for each parameter, i.e., airspeed, time, altitude, etc. The remainder of the data would primarily be beneficial to the maintenance crew for that specific aircraft.

The next output from LCOMP is shown in Table 5. This output shows the specific value for each parameter in each band; e.g., average altitude is 424.93 ft. in Band 1, and 856.58 ft. in Band 2. The parameters are defined in Table 1, with the exception of PA, atmospheric pressure, and QC, dynamic pressure, both in inches of mercury. All units in Table 5 are shown times 1000 except for altitude and velocity. For example, PA = 20920 is actually 20.920 in. of mercury. Altitude (ALT) is in units of feet, and velocity (VCAL) is in units of knots. The column labeled COUNTS is actually the band number, varying from 0 to 63. This number corresponds to the number shown on the tabular portion of the output (see Table 3) and positions the parameter's appropriate symbol in the appropriate position in the graphical output to the right, as shown in Table 3.

The last portion of output from the program LCOMP is the tabular and graphical representation of the data. All symbols are shown and explained in Tables 1 and 5, with a typical example of output in Table 3. Table 3 shows the option of both tabular and graphical representation of the data. The first 8 columns (tabular chart) list the band that each of the eight parameters falls into. The ninth column is the time represented in 1/30's of a second. The 64 columns following

IDENTIFICATION DATA

FILES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1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TABLE 5. ENGINEERING UNITS OF EACH DATA BAND

ENGINEERING UNIT: 10000 FOR FILE NO.										
COUNTS	PAIING	UL (INRG)	NZ (INRG)	HT (INRG)	HA (INRG)	PID (INRG)	U (INRG)	M (INRG)	AL (INRG)	VCAL (INRG)
0	24920	857	3125	2296	1755	361280	-60384	-62131	-1.33	133.12
1	24902	1328	2429	2228	1697	350031	-58491	-60225	424.43	177.07
2	24004	2144	2735	2100	1034	338782	-58546	-58514	636.58	211.61
3	28504	2670	2537	2042	1581	327553	-58705	-58413	1293.74	240.84
4	28008	3541	2341	2024	1523	316284	-52812	-52801	1736.72	268.63
5	27630	4212	2145	1956	1465	305035	-50919	-52601	2185.53	289.63
6	27112	4863	1949	1868	1407	293786	-49026	-50695	2640.41	310.74
7	26714	5554	1753	1820	1344	282537	-47133	-48789	3101.54	330.23
8	26236	6225	1557	1752	1291	271266	-45240	-46863	3509.12	348.40
9	25798	6860	1361	1684	1253	260039	-43347	-44977	4043.35	365.44
10	25340	7567	1165	1610	1175	248790	-41454	-43071	4524.44	381.52
11	24882	8236	969	1548	1117	237541	-39561	-41165	5012.63	396.78
12	24424	8909	773	1480	1059	226292	-37688	-39254	5506.15	411.25
13	23968	9500	577	1412	1001	215043	-35775	-37353	6011.25	425.07
14	23508	10251	381	1344	943	203794	-33882	-35447	6522.20	438.33
15	23050	10922	185	1276	885	192545	-31989	-33541	7041.28	451.00
16	22592	11543	11	1208	827	181296	-30096	-31635	7568.77	463.21
17	22134	12204	207	1140	769	170047	-28203	-29724	8105.00	474.97
18	21676	12935	403	1072	711	158798	-26310	-27823	8650.29	486.31
19	21218	13666	599	1004	653	147549	-24417	-25911	9204.96	497.27
20	20760	14277	795	936	595	136300	-22524	-24011	9769.46	507.84
21	20302	14948	941	868	537	125051	-20631	-22105	10344.12	518.17
22	19884	15619	1187	800	479	113802	-18736	-20194	10924.37	528.15
23	19368	16290	1383	732	421	102555	-16845	-18293	11525.66	537.84
24	18928	16961	1579	664	363	91304	-14952	-16387	12133.47	547.26
25	18470	17632	1775	596	305	80055	-13059	-14481	12753.31	556.43
26	18012	18303	1971	528	247	68806	-11166	-12575	13385.72	565.36
27	17554	18974	2167	460	189	57557	-9273	-10664	14031.30	574.06
28	17096	19645	2363	392	131	46308	-7380	-8763	14690.65	582.55
29	16638	20316	2554	324	73	35059	-5487	-6857	15364.47	590.84
30	16180	20987	2755	256	15	23810	-3594	-4951	16053.48	598.94
31	15722	21658	2951	188	43	12561	-1701	-3045	16758.47	606.86
32	15264	22329	3147	120	101	1312	192	-1139	17480.24	614.00
33	14806	23000	3343	52	159	9437	2085	767	18219.86	622.17
34	14348	23671	3539	64	217	21166	3978	2673	18978.20	629.59
35	13890	24342	3735	10	275	32435	5871	4574	19756.40	636.88
36	13432	25013	3931	152	333	43684	7764	6485	20555.60	643.98
37	12974	25684	4127	220	391	54933	9657	8391	21377.31	650.96
38	12516	26355	4323	288	444	66162	11550	10297	22222.78	657.81
39	12058	27026	4519	356	507	77431	13443	12203	23093.69	664.55
40	11600	27697	4715	424	565	88680	15536	14109	23991.82	671.15
41	11142	28368	4911	492	623	99429	17224	16015	24919.13	677.64
42	10684	29039	5107	560	681	111176	19122	17921	25877.64	684.03
43	10226	29710	5303	628	739	122427	21015	19827	26870.43	690.31
44	9768	30381	5499	696	797	133676	22908	21733	27899.69	696.51
45	9310	31052	5695	764	855	144425	24801	23639	28968.80	702.61
46	8852	31723	5891	832	913	156174	26694	25545	30081.39	708.64
47	8394	32394	6087	900	971	167423	28587	27451	31241.61	714.58
48	7936	33065	6283	966	1029	178672	30480	29357	32454.27	720.45
49	7478	33736	6479	1036	1087	189521	32373	31263	33725.00	726.25
50	7020	34407	6675	1104	1145	201170	34266	33169	35066.40	731.98
51	6562	35078	6871	1172	1203	212419	36159	35075	36470.14	737.65
52	6104	35749	7067	1240	1261	223668	38052	36981	37975.47	743.26
53	5646	36420	7263	1300	1319	234917	39945	38687	39596.26	748.80
54	5188	37091	7459	1376	1377	246166	41838	40793	41358.41	754.29
55	4730	37762	7655	1444	1435	257415	43731	42699	43281.34	759.73
56	4272	38433	7851	1512	1493	268664	45624	44605	45400.27	765.11
57	3814	39104	8047	1580	1551	279513	47517	46511	47759.72	770.44
58	3356	39775	8243	1648	1609	291162	49410	48417	50421.36	775.72
59	2898	40446	8439	1716	1667	302411	51303	50323	53474.20	780.96
60	2440	41117	8635	1784	1725	313660	53196	52229	57053.27	786.15
61	1982	41768	8831	1852	1783	324804	55069	54135	61378.62	791.29
62	1524	42459	9027	1920	1841	336158	56982	56041	66845.72	796.39
63	1066	43130	9223	1988	1899	347407	58875	57947	74262.23	801.45

the tabular chart are a graphical representation of the same data, plotted with the parameter symbols shown in their band position. That is, altitude (A) = 6 and yaw (R) = 8 causes "A" to be printed in column 6, and "R" in column 8. The step increments used throughout the tabular or graphical output is based on time in 1/30's of a second. The output only prints when a specific item changes bands. All data not displayed between several time steps can be assumed to remain within the last band shown until the output is printed again. The values for the parameters can change between printed lines as long as the values remain within the bands and do not exceed a threshold value that will put them into the next band.

### III. ANALYSIS OF THE DATA

Eight tapes containing 64 files with collected flight loads data from 84 magazines were examined. All of the compressed data was run through the program LCOMP and then viewed by hand to determine its true validity.

Some data was determined to be unreasonable for several reasons. A short list of examples follows:

- (1) There should not be any altitude jumps in the graph for a short period of time. Altitude should usually only change one band in 1/30th of a second.
- (2) Straight and level flight should yield very little variation in roll, pitch, and yaw.
- (3) All data elements must be in the chart for the chart to be considered valid.

Tables 6 and 7 show typical examples of bad data. Table 6 shows a drastic jump in altitude from band 6 to band 62. During the short period of time involved (2/30 second), the altitude could not possibly jump from 3,100 feet to 66,845 feet. As a result, this section of data is not usable.  $N_x$  acceleration of the aircraft also shows a corresponding jump from band 30 to band 62. This jump in data appears to be caused by a transient voltage as the recorder is being shut down and then turned on again approximately three minutes later. From this point on,  $N_x$  remains in band 62, indicating that the aircraft is decelerating at a constant 1.841 g. The remaining channels of data appear constant and can be assumed to represent valid data, except for  $N_z$ . Additional analysis shows  $N_z$  to vary from band 31 to band 62, representing a vertical acceleration ranging from 2.755 g to 9.027 g, typically averaging around 4.0 g. Since altitude remains in band 6, representing 2,640 feet, these values of  $N_z$  do not appear valid and this entire section of data must be discarded.

TABLE 6. EXAMPLE OF ERRONEOUS DATA

[illegible]

TABLE 7. EXAMPLE OF ERRONEOUS DATA

AE 10VE	72	351E	33AE	62PE	32UE	37AE	331PE	115714	V A	P1 Z U
AE 10VE	72	341E	33AE	62PE	32UE	37AE	331PE	115711	VA	P1 Z U
AE 10VE	72	351E	33AE	62PE	32UE	37AE	331PE	115770	V A	P1 Z U
AE 10VE	72	351E	33AE	62PE	32UE	37AE	331PE	115761	V A	P1 Z U
AE 10VE	72	351E	33AE	62PE	32UE	37AE	331PE	115762	V A	P1 Z U
AE 10VE	72	351E	33AE	62PE	32UE	37AE	331PE	115766	V A	P1 Z U
AE 10VE	72	351E	33AE	62PE	32UE	37AE	331PE	115701	V A	P1 Z U
AE 10VE	72	351E	33AE	62PE	32UE	37AE	331PE	115700	V A	P1 Z U
AE 12VE	72	351E	33AE	62PE	32UE	37AE	331PE	115769	V A	P1 Z U
AE 12VE	72	351E	33AE	62PE	32UE	37AE	331PE	115740	V A	P1 Z U
AE 10VE	72	351E	33AE	62PE	32UE	37AE	331PE	115791	V A	P1 Z U
AE 10VE	72	341E	33AE	62PE	32UE	37AE	331PE	115792	V A	P1 Z U
AE 10VE	72	341E	33AE	62PE	32UE	37AE	331PE	115744	V A	P1 Z U
AE 12VE	72	351E	33AE	62PE	32UE	37AE	331PE	115745	V A	P1 Z U
AE 14VE	72	351E	33AE	62PE	32UE	37AE	331PE	115746	V A	P1 Z U
AE 14VE	72	351E	33AE	62PE	32UE	37AE	331PE	115797	V A	P1 Z U
AE 14VE	72	351E	33AE	62PE	32UE	37AE	331PE	115744	V A	P1 Z U
AE 14VE	72	351E	33AE	62PE	32UE	37AE	331PE	115800	V A	P1 Z U
AE 14VE	72	351E	33AE	62PE	32UE	37AE	331PE	115801	V A	P1 Z U
AE 12VE	72	321E	33AE	62PE	32UE	37AE	331PE	115804	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	115911	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	115911	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	115915	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	115915	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	115916	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	115916	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115919	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115921	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115922	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115923	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115925	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115927	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115928	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115929	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115930	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	115931	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	115932	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	115935	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	115934	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	115935	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	116246	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	116302	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	116314	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	116314	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	116320	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	116320	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	116327	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	116324	V A	P1 Z U
AE 0VE	62	321E	33AE	62PE	32UE	37AE	331PE	116330	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	116601	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	116603	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	116604	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	116624	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	116627	V A	P1 Z U
AE 10VE	62	311E	33AE	62PE	32UE	37AE	331PE	116628	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	116630	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	116634	V A	P1 Z U
AE 0VE	62	311E	33AE	62PE	32UE	37AE	331PE	116642	V A	P1 Z U
AE 12VE	62	311E	33AE	62PE	32UE	37AE	331PE	116678	V A	P1 Z U
AE 12VE	62	311E	33AE	62PE	32UE	37AE	331PE	116680	V A	P1 Z U
AE 12VE	62	321E	33AE	62PE	32UE	37AE	331PE	116681	V A	P1 Z U



Table 7 shows a pattern of constantly changing altitude, which suggests that the aircraft is going through a maneuver. Careful examination of the data shows that the altitude changes by 1385 feet in 1/30th of a second, which is not possible; and again all of this data must be eliminated.

After analyzing all the 9-track compressed data tapes it was determined that the earlier test flights yielded the best data. During later flights, many channels of output data were found unusable. Instrumentation errors along with flight recorder upkeep were apparently the cause for this unusable data. The first channel of data to deteriorate was altitude, and this is the most serious loss of data.

Despite the amount of invalid data, the data tapes appear to contain sufficient usable A-7D flight loads data so that data reduced in this effort will reflect A-7D usage accurately.

A primary difficulty to be encountered when reviewing all data tapes is that the calibration data varies from recorder to recorder. Deciding upon a common set of bands for each parameter is necessary to consolidate the data into a large file of usable information.

Histograms of time in bands for vertical load factors, altitude, and airspeed can be prepared and exceedance curves of load factors and roll rates can be established. Meaningful correlation tables of the various parameters are possible as shown in Table 8. However, because of the loss of some of the data, particularly altitude, there is insufficient data to produce some of the correlations. The most important correlations or cross-correlations are usually  $N_z$  with other parameters that affect calculations of aircraft loads. For example, simultaneous peaking of  $N_z$  and roll create asymmetric wing loading. Other correlations are possible, but probably not as meaningful.

A great deal of manual analysis and interpretation will be required to eliminate faulty data, in order to insure that the data used in the analysis is valid.

TABLE 8  
MATRIX OF POSSIBLE MEANINGFUL CORRELATIONS

PEAKING PARAMETER	CORRELATIONS				
$N_z$	$N_z \cdot N_y$	$N_z \cdot Q$	$N_z \cdot P$	$N_z \cdot R$	$N_z \cdot A \cdot V$
$N_y$	$N_y \cdot N_z$	$N_y \cdot Q$	$N_y \cdot P$	$N_y \cdot R$	$N_y \cdot A$
PITCH (Q)	$Q \cdot N_z$	$Q \cdot N_y$	$Q \cdot A$		
ROLL (P)	$P \cdot N_z$	$P \cdot N_y$	$P \cdot A$		
YAW (R)	$R \cdot N_z$	$R \cdot N_y$	$R \cdot A$		